WHAT IS CLAIMED IS:

1. A data processing method using error-correcting code, comprising the steps of:

creating a P-byte error-correcting code PI for each row in a data block composed of (M × N) bytes in M rows × N columns and adding the error-correcting code PI to the row by use of a first memory;

gathering together K error-correcting code PI-added data blocks composed of (M × (N + P)) bytes in M rows × (N + P) columns in a second memory to create a collective data block containing (K × (M × (N + P))) bytes;

creating an S-byte error-correcting code PO for each column in said collective data block and adding the error-correcting code PO to the column by use of said second memory to create an error-correcting product code block (ECC block);

performing an error correcting process using the error-correcting code PI added to each row before reading said ECC block from said second memory and transmitting the ECC block; and

transmitting the ECC block subjected to said error correcting process or recording the ECC block onto a recording medium sequentially in the order of row.

2. A data processing method using error-correcting code, comprising the steps of:

creating a P-byte error-correcting code PI for

each row in a data block composed of (M × N) bytes in M rows × N columns and adding the error-correcting code PI to the row by use of a first memory;

gathering together K error-correcting code PI-added data blocks composed of (M × (N + P)) bytes in M rows × (N + P) columns in a second memory to create a collective data block containing (K × (M × (N + P)));

creating an (S = K × Q)-byte error-correcting code PO for each column in said collective data block and adding the error-correcting code PO to the column by use of said second memory;

distributing said error-correcting code PO in units of Q bytes to the K error-correcting code PI-added data blocks to cause each block to constitute an error-correcting product code block (ECC block) which is composed of data and error-correcting code and contains a constant value of (M + Q) × (N + P) bytes;

performing an error correcting process using the error-correcting code PI added to each row before reading said ECC block from said second memory and transmitting the ECC block; and

transmitting the ECC block subjected to said error correcting process or recording the ECC block onto a recording medium sequentially in the order of row.

3. A data processing method using error-correcting code, comprising the steps of:

when an error-correcting code PI is created for

each row in a data block composed of (M × N) bytes in M rows × N columns and added to the row,

including a first process of receiving the data in each row (containing N bytes) from a host computer and storing the transmitted N bytes of data sequentially in a second memory and a second process of creating a P-byte error-correcting code for each of said rows on the basis of said transmitted N bytes of data in parallel with the first process and storing the created P-byte error-correcting code PI sequentially into said second memory, and creating an error-correcting code PI-added data block composed of (M × (N + P)) bytes in M rows × (N × P) columns;

gathering together K error-correcting code PI-added data blocks composed of (M × (N + P)) bytes in M rows × (N + P) columns in a second memory to create a collective data block containing (K × (M × (N + P))) bytes;

creating an S-byte error-correcting code PO for each column in said collective data block and adding the error-correcting code PO to the column by use of said second memory to create an error-correcting product code block (ECC block);

performing an error correcting process using the error-correcting code PI added to each row before reading said ECC block from said second memory and transmitting the ECC block; and

transmitting the ECC block subjected to said error correcting process or recording the ECC block onto a recording medium sequentially in the order of row.

4. The data processing method according to claim 1, 2, or 3, wherein only the rows of the error-correcting code PO are subjected to the error correcting process, when the error correcting process is performed on said ECC block on the basis of said error-correcting code PI.

5. The data processing method according to claim 1, 2, or 3, wherein

each row of said ECC block is read sequentially from said second memory and stored in a third memory,

the error correcting process is performed on either each row in the data block stored in said third memory or the row of the error-correcting code PO, when the error correction process is performed on a unit block stored in said third memory on the basis of the error-correcting code PI, and

transmitting the unit block subjected to said error correcting process or recording the unit block onto a recording medium sequentially in the order of row.

6. A data processing method using error-correcting code, comprising the steps of:

when an error-correcting code PI-added collective data block containing (K $\times$ M $\times$ (N + P)) bytes and

an error-correcting code PO block containing (S × (N + P)) bytes are transmitted or read from a recording medium and received, the collective data block being such that a P-byte error-correcting code PI is added to each row of a collective data block putting together K data blocks composed of (M × N) bytes in M rows × N columns and containing (K × (M × N)) bytes, and said error-correcting code PO block being such that an S-byte error-correcting code PO is created for each column of said collective data block included error-correcting code PI block,

performing a first error correcting process on error data bytes in said collective data block on the basis of said error-correcting codes PI and PO by use of a second memory; and

performing a row error correcting process on the data subjected to said first error correcting process, on the basis of said error-correcting code PI by use of a first memory.

7. A data processing method using error-correcting code, comprising the steps of:

when an error-correcting product code block (ECC block) is transmitted or read from an recording medium and received, said ECC block being such that a P-byte error-correcting code PI is created for each row in a data block composed of (M × N) bytes in M rows × N columns and the error-correcting code PI is added to

the row, that K error-correcting code PI-added data blocks composed of (M × (N + P)) bytes in M rows × (N + P) columns are gathered together to create a collective data block containing (K × (M × (N + P))) bytes, that an (S = K × Q)-byte error-correcting code PO is created for each column in said collective data block and added to the column, and that said error-correcting code PO is distributed in units of Q bytes to the K error-correcting code PI-added data blocks to cause each data block to be composed of data and error-correcting code, containing a constant value of (M + Q) × (N + P) bytes,

performing an error correcting process on error data bytes in said data block on the basis of said error-correcting codes PI and PO by use of a second memory, and thereafter

performing a row error correcting process on the data subjected to said first error correcting process, on the basis of said error-correcting code PI by use of a first memory.

8. The data processing method according to claim 6 or 7, wherein the error correcting process using said first memory is carried out only when it is judged in reading the data from said second memory from the error-correcting code (EDC) added to said data block that an error is present in said data block.

9. A data processing method using

error-correcting code, comprising the steps of:

creating a P-byte error-correcting code PI for each row in a data block composed of (M × N) bytes in M rows N × columns and adding the error-correcting code PI to the row by use of a first memory to form a data block;

gathering together K units of said error-correcting code PI-added data block composed of (M × (N + P) bytes in M rows × (N + P) columns in a second memory to form a collective data block containing (K × (M × (N + P))) bytes and creating an S-byte error-correcting code PO for each column in said collective data block and adding the error-correcting code PO to the column by use of said second memory to form an error-correcting product code block (ECC block);

carrying out an error correcting process using the error-correcting code PI added to each row of said ECC block before the ECC block is read from said second memory and transmitted;

transmitting the ECC block subjected to said error correcting process or recording the ECC block onto a recording medium sequentially in the order of row;

performing a first error correcting process on error data bytes in said data block on the basis of said error-correcting codes PI and PO by use of said second memory, when the ECC block subjected to said error correcting process is transmitted or read from an

recording medium and received; and

performing a row error correcting process on the data subjected to said first error correcting process on the basis of said error-correcting code PI by use of a first memory.

10. A data processing method using error-correcting code, comprising the steps of:

creating a P-byte error-correcting code PI for each row in a data block composed of (M × N) bytes in M rows × N columns and adding the error-correcting code PI to the row by use of a first memory to form a collective data block;

gathering together K units of said error-correcting code PI-added data block composed of (M × (N + P) bytes in M rows × (N + P) columns in a second memory to form a collective data block containing (K × (M × (N + P))) bytes and creating an (S = K × Q)-byte error-correcting code PO for each column in said collective data block and adding the error-correcting code PO to the column by use of said second memory;

distributing said error-correcting code PO in units of Q bytes to the K error-correcting code PI-added data blocks to construct an error-correcting product code block (ECC block) in such a manner that each data block contains a constant value of (M + Q) × (N + P) bytes composed of a data block and error-correcting code;

carrying out an error correcting process using the error-correcting code PI added to each row in said ECC block before the ECC block is read from said second memory and transmitted;

transmitting the ECC block subjected to said error correcting process or recording the ECC block onto a recording medium sequentially in the order of row;

performing a first error correcting process on error data bytes in said data block on the basis of said error-correcting codes PI and PO by use of said second memory, when the ECC block subjected to said error correcting process is transmitted or read from an recording medium and received; and

performing a row error correcting process on the data subjected to said first error correcting process on the basis of said error-correcting code PI by use of a first memory.

11. The data processing method according to claim 9 or 10, wherein the error correcting process is performed on error data bytes including memory errors in recording on the basis of the error-correcting code PI by use of said second memory, before the first error correcting process is performed on error data bytes in said data block on the basis of said error-correcting codes PI and PO by use of said second memory.

12. The data processing method according to any one of claims 1, 2, 3, 6, 7, 9, and 10, wherein said

first memory is an SRAM (Static-RRM).

13. The data processing method according to any one of claims 1, 2, 3, 6, 7, 9, and 10, wherein the error correcting process using said error-correcting code PI is to sense an error by calculating only part (R bytes, R < P) of the pattern sense value (P bytes) obtained from the P-byte error-correcting code PI and, only when it is judged that there is an error, carry out a correcting process.

14. A data processing device which obtains error-correcting-code-added data using a data processing method according to any one of claims 1, 2, and 3, when the error-correcting-code-added data is transmitted or recorded onto a recording medium.

15. A data processing device which obtains error-corrected output data using a data processing method according to claim 6 or 7, when the error-correcting-code-added data is transmitted or read from a recording medium and received.

16. A data processing device which obtains error-correcting-code-added data or error-corrected output data using a data processing method according to claim 9 or 10, when the error-correcting-code-added data is transmitted or recorded onto a recording medium or when error-correcting-code-added data is transmitted or read from a recording medium and received.

17. A data processing device using

error-correcting code, comprising:

means for creating a P-byte error-correcting code PI for each row in a data block composed of (M × N) bytes in M rows × N columns and adding the error-correcting code PI to the row by use of a first memory;

means for gathering together K error-correcting code PI-added data blocks composed of (M × (N + P)) bytes in M rows × (N + P) columns in a second memory to create a collective data block containing (K × (M × (N + P))) bytes;

means for creating an S-byte error-correcting code PO for each column in said collective data block and adding the error-correcting code PO to the column by use of said second memory to create an error-correcting product code block (ECC block);

means for performing an error correcting process using the error-correcting code PI added to each row before reading said ECC block from said second memory and transmitting the ECC block; and

means for transmitting the ECC block subjected to said error correcting process sequentially or recording the ECC block onto a recording medium in the order of row.

18. A data processing device using error-correcting code, comprising:

means for creating a P-byte error-correcting code PI for each row in a data block composed of

(M × N) bytes in M rows × N columns and adding the error-correcting code PI to the row by use of a first memory;

means for gathering together K error-correcting code PI-added data blocks composed of (M × (N + P)) bytes in M rows × (N + P) columns in a second memory to create a collective data block containing (K × (M × (N + P))) bytes;

means for creating an (S = K × Q)-byte error-correcting code PO for each column in said collective data block and adding the error-correcting code PO to the column by use of said second memory;

means for distributing said error-correcting code PO in units of Q bytes to the K error-correcting code PI-added data blocks to cause each data block to constitute an error-correcting product code block (ECC block) which is composed of data and error-correcting code and contains a constant value of (M + Q) × (N + P) bytes;

means for performing an error correcting process using the error-correcting code PI added to each row before reading said ECC block from said second memory and transmitting the ECC block; and

means for transmitting the ECC block subjected to said error correcting process or recording the ECC block onto a recording medium sequentially in the order of row.

19. A data processing device using error-correcting code, comprising:

when an error-correcting code PI is created for each row in a data block composed of (M × N) bytes in M rows × N columns and added to the row,

means for including a first process of receiving the data in each row (containing N bytes) from a host computer and storing the transmitted N bytes of data sequentially in a second memory and a second process of creating a P-byte error-correcting code for each of said rows on the basis of said transmitted N bytes of data and storing the created P-byte error-correcting code PI sequentially into said second memory in parallel with the first process, and creating a error-correcting code PI-added data block composed of (M × (N + P)) bytes in M rows × (N × P) columns;

means for gathering together K error-correcting code PI-added data blocks composed of (M × (N + P)) bytes in M rows × (N + P) columns in a second memory to create a collective data block containing (K × (M × (N + P))) bytes;

means for creating an S-byte error-correcting code PO for each column in said collective data block and adding the error-correcting code PO to the column by use of said second memory to create an error-correcting product code block (ECC block);

means for performing an error correcting process

using the error-correcting code PI added to each row before reading said ECC block from said second memory and transmitting the ECC block; and

transmitting the ECC block subjected to said error correcting process or recording the ECC block onto a recording medium sequentially in the order of row.

20. The data processing device according to claim 17, 18, or 19, wherein only the rows of the error-correcting code PO are subjected to the error correcting process, when the error correcting process is performed on said ECC block on the basis of said error-correcting code PI.

21. The data processing device according to claim 17, 18, or 19, further comprising

means for reading each row of said ECC block sequentially from said second memory and storing the row in a third memory,

means for performing the error correcting process on either each row in the data block stored in said third memory or the row of the error-correcting code PO, when the error correcting process is performed on a unit block stored in said third memory on the basis of the error-correcting code PI, and

means for transmitting the unit block subjected to said error correcting process or recording the unit block onto a recording medium sequentially in the order of row.

22. A data processing device using error-correcting code, comprising:

when an error-correcting code PI-added collective data block containing (K × M × (N + P)) bytes and an error-correcting code PO block containing (S × (N + P)) bytes are transmitted or read from a recording medium and received, the collective data block being such that a P-byte error-correcting code PI is added to each of a collective data block putting together K data blocks composed of (M × N) bytes in M rows × N columns and containing (K × (M × N))) bytes, and said error-correcting code PO block being such that an S-byte error-correcting code PO is created for each column of said collective data block and of said error-correcting code PI-added block,

means for performing a first error correcting process on error data bytes in said collective data block on the basis of said error-correcting codes PI and PO by use of a second memory; and

means for performing a row error correcting process on the data subjected to said first error correcting process, on the basis of said error-correcting code PI by use of a first memory.

23. A data processing device using error-correcting code, comprising:

when an error-correcting product code block (ECC block) is transmitted or read from an recording medium

and received, said ECC block being such that a P-byte error-correcting code PI is created for each row in a data block composed of (M × N) bytes in M rows × N columns and the error-correcting code PI is added to the row, that K error-correcting code PI-added data blocks composed of (M × (N + P)) bytes in M rows × (N + P) columns are gathered together to create a collective data block containing (K × (M × (N + P))) bytes, that an (S = K × Q)-byte error-correcting code PO for each column in said collective data block is created and added to the column, and that said error-correcting code PO is distributed in units of Q bytes to the K error-correcting code PI-added data blocks to cause each data block to be composed of data and error-correcting code, containing a constant value of (M + Q) × (N + P) bytes,

means for performing an error correcting process on error data bytes in said data block on the basis of said error-correcting codes PI and PO by use of a second memory; and

means for performing a row error correcting process on the data subjected to said first error correcting process, on the basis of said error-correcting code PI by use of a first memory.

24. The data processing device according to claim 22 or 23, wherein the error correcting process using said first memory is carried out only when it is

judged in reading the data from said second memory from the error-correcting code (EDC) added to said data block that an error is present in said data block.

25. A data processing device using error-correcting code, comprising:

means for creating a P-byte error-correcting code PI for each row in a data block composed of (M × N) bytes in M rows × N columns and adding the error-correcting code PI to the row by use of a first memory to form a data block;

means for gathering together K units of said error-correcting code PI-added data block composed of (M × (N + P) bytes in M rows × (N + P) columns in a second memory to form a collective data block containing (K × (M × (N + P))) bytes and creating an S-byte error-correcting code PO for each column in said collective data block and adding the error-correcting code PO to the column by use of said second memory to form an error-correcting product code block (ECC block);

means for carrying out an error correcting process using the error-correcting code PI added to each row in said ECC block before the ECC block is read from said second memory and transmitted;

means for transmitting the ECC block subjected to said error correcting process or recording the ECC block onto a recording medium sequentially in the order

of row;

means for performing a first error correcting process on error data bytes in said data block on the basis of said error-correcting codes PI and PO by use of said second memory, when the ECC block subjected to said error correcting process is transmitted or read from an recording medium and received; and

means for performing a row error correcting process on the data subjected to said first error correcting process on the basis of said error-correcting code PI by use of a first memory.

26. A data processing device using error-correcting code, comprising:

means for creating a P-byte error-correcting code PI for each row in a data block composed of (M × N) bytes in M rows × N columns and adding the error-correcting code PI to the row by use of a first memory to form a collective data block;

means for gathering together K units of said error-correcting code PI-added data block composed of (M × (N + P) bytes in M rows × (N + P) columns in a second memory to form a collective data block containing (K × (M × (N + P))) bytes;

means for creating an (S = K × Q)-byte error-correcting code PO for each column in said collective data block and adding the error-correcting code PO to the column by use of said second memory;

means for distributing said error-correcting code PO in units of Q bytes to the K error-correcting code PI-added data blocks to construct an error-correcting product code block (ECC block) in such a manner that each data block contains a constant value of (M + Q) × (N + P) bytes composed of a data block and error-correcting code;

means for carrying out an error correcting process using the error-correcting code PI added to each row in said ECC block before the ECC block is read from said second memory and transmitted;

means for transmitting the ECC block subjected to said error correcting process or recording the ECC block onto a recording medium sequentially in the order of row;

means for performing a first error correcting process on error data bytes in said data block on the basis of said error-correcting codes PI and PO by use of said second memory, when the ECC block subjected to said error correcting process is transmitted or read from an recording medium and received; and

means for performing a row error correcting process on the data subjected to said first error correcting process on the basis of said error-correcting code PI by use of a first memory.

27. The data processing device according to claim 25 or 26, further comprising means for performing

the error correcting process on error data bytes including memory errors in recording on the basis of the error-correcting code PI by use of said second memory, before the first error correcting process is performed on error data bytes in said data block on the basis of said error-correcting codes PI and PO by use of said second memory.

28. The data processing device according to any one of claims 17, 18, 19, 22, 23, 25, and 26, wherein said first memory is an SRAM (Static-RRM).

29. The data processing device according to any one of claims 17, 18, 19, 22, 23, 25, and 26, wherein said means for performing the error correcting process using said error-correcting code PI senses an error by calculating only part (R bytes, $R < P$) of the pattern sense value (P bytes) obtained from the P-byte error-correcting code PI and, only when it is judged that there is an error, carries out a correcting process.

30. A data processing device comprising:

means for creating an error-correcting code PI for each row in a data block and storing both the error-correcting code PI and said data block into a memory; and

means for performing an error correcting process on the rows of the data block on the basis of said error-correcting code PI, when an error-correcting code PI-added data block is read from said memory in a

transmission or recording system.

31. A data processing device comprising means for, when a collective data block subjected to an error correcting process using an error-correcting code PI is read from a memory, performing the error correcting process using said error-correcting code PI again on the rows of the collective data block.

32. A data processing device using error-correcting code, comprising:

PI creating and adding means for creating an error-correcting code PI (containing P bytes) for each row in a plurality of rows of data, one row containing N bytes, and adding the error-correcting code PI to the row;

a buffer memory for storing the error-correcting code PI-added data obtained by said PI creating and adding means, one row containing N + P bytes;

PI error correcting means for correcting errors in each row using the error-correcting code PI added to each row before reading said data from said buffer memory and transmitting the data; and

memory control means for, when the PI error correcting means has performed error correction, memorizing information on the memory area in said buffer memory where the data in which an error was sensed is stored and replacing the memory area in said buffer memory where the data in which an error was

sensed repeatedly is stored with another memory area.

33. A data processing device using error-correcting code, comprising:

PI creating and adding means for creating an error-correcting code PI (containing P bytes) for each row in a plurality of rows of data sent from a host computer, one row containing N bytes, and adding the error-correcting code PI to the row;

a buffer memory for storing the error-correcting code PI-added data obtained by said PI creating and adding means, one row containing N + P bytes;

PO creating and adding means for gathering together K error-correcting code PI-added data blocks, each data block composed of (M × (N + P)) bytes in M rows × (N + P) columns, to form a collective data block containing (K × (M × (N + P))) bytes, and creating an S-byte error-correcting code PO for each column in said collective data block and adding the error-correcting code PO to the column to form an error-correcting product code block (ECC block);

PI error correcting means for correcting errors in each row using the error-correcting code PI added to each row before reading said data from said buffer memory and transmitting the data; and

control means for requesting the data before the addition of said error-correcting code PI from said host computer again and making this data the

error-correcting code PI-added data in a case where it is sensed that the correctable number of errors has been exceeded when the PI error correcting means has performed error correction, and specifying a second storage area different from a first storage area in which said data was stored last time, when storing the error-correcting code PI-added data in said buffer memory.

34. A data processing device using error-correcting code, comprising:

PI creating and adding means for creating an error-correcting code PI (containing P bytes) for each row in a plurality of rows of data, one row containing N bytes, and adding the error-correcting code PI to the row;

a buffer memory for storing the PI error-correcting code-added data obtained by said PI creating and adding means, one row containing N + P bytes;

PO creating and adding means for gathering together K error-correcting code PI-added data blocks, each data block composed of (M × (N + P)) bytes in M rows × (N + P) columns, to form a collective data block containing (K × (M × (N + P))) bytes, and creating an S-byte error-correcting code PO for each column in said collective data block and adding the error-correcting code PO to the column to form an error-correcting product code block (ECC block);

PI error correcting means for correcting errors in each row using the error-correcting code PI added to each row before reading said data from said buffer memory and transmitting the data; and

control means for moving said collective data block containing (K × (M × (N + P))) bytes stored in a first area in said buffer memory to a second area in said buffer memory in a case where it is sensed that the correctable number of errors has been exceeded when the PI error correcting means has corrected errors in the row in which said error-correcting code PO is present, and creating an S-byte error-correcting code PO for each column in said collective data block containing (K × (M × (N + P))) bytes in said second area and adding the error-correcting code PO to the column via said PO creating and adding means.

35. A data processing device using error-correcting code, comprising:

when an error-correcting code PI-added collective data block containing (K × M × (N + P)) bytes and an error-correcting code PO block containing (S × (N + P)) bytes are received from transmission means or a recording medium, the collective data block being such that a P-byte error-correcting code PI is added to each of a collective data block putting together K data blocks composed of (M × N) bytes in M rows × N columns and containing (K × (M × N)) bytes, and said

error-correcting code PO block being such that an S-byte error-correcting code PO is created for each column of said collective data block and of said error-correcting code PI-added block,

first means for performing a first error correcting process on error data bytes in said collective data block on the basis of said error-correcting codes PI and PO by use of a buffer memory;

second means for performing a second error correcting process on the rows in the data subjected to said first error correcting process, on the basis of said error-correcting code PI by use of a small memory smaller in capacity than that of said buffer memory; and

memory control means for, when the second means performs error correction in the PI series, memorizing information on the memory area in said buffer memory where the data in which an error was sensed is stored and replacing the memory area in said buffer memory where the data in which an error was sensed repeatedly is stored with another memory area.

36. A data processing device using error-correcting code, comprising:

when an error-correcting product code block (ECC block) is received from transmission means or an recording medium, said ECC block being such that a P-byte error-correcting code PI is created for each row

in a data block composed of (M × N) bytes in M rows × N columns and the error-correcting code PI is added to the row, that K error-correcting code PI-added data blocks composed of (M × (N + P)) bytes in M rows × (N + P) columns are gathered together to create a collective data block containing (K × (M × (N + P))) bytes, that an (S = K × Q)-byte error-correcting code PO is created for each column in said collective data block and added to the column, and that said error-correcting code PO is distributed in units of Q bytes to the K error-correcting code PI-added data blocks to cause each data block to be composed of data and error-correcting code containing a constant value of (M + Q) × (N + P) bytes,

first means for performing a first error correcting process on error data bytes in said data block on the basis of said error-correcting codes PI and PO by use of a buffer memory;

second means for performing a second error correcting process on the rows in the data subjected to said first error correcting process, on the basis of said error-correcting code PI by use of a small memory smaller in capacity than that of said buffer memory; and

control means for requesting the data added said error-correcting code PI from said transmission means or recording medium again in a case where it is sensed

that the correctable number of errors has been exceeded when the second means has performed PI correction, and specifying a second storage area different from a first storage area in which said data was stored last time, when storing the data in said buffer memory.